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(54) **Expiration cassette**

(57) An expiration cassette (14) for a ventilator and comprising a gas passage, an expiratory valve and a flow meter is disclosed. The expiratory cassette (14) al-

so comprises a locking mechanism (20, 24A, 24B, 28A, 28B, 30, 32) for locking and unlocking interaction with a receiving section (22) in the ventilator.

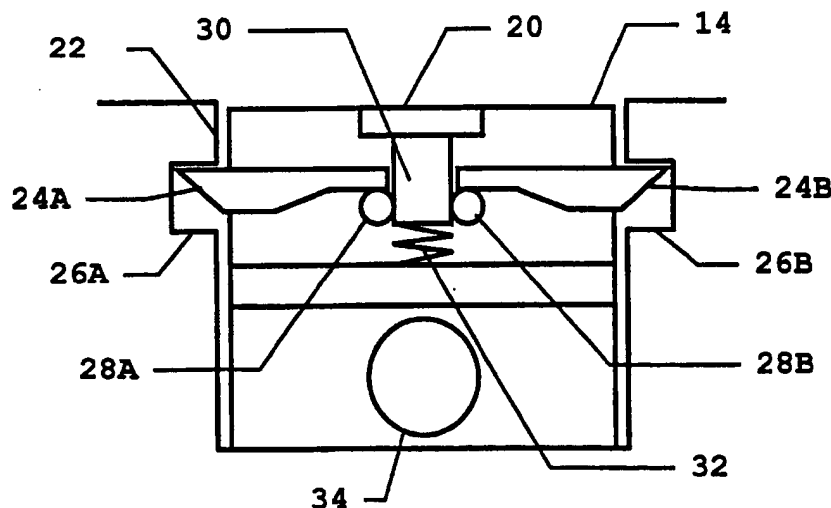


FIG. 2

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Description

[0001] The present invention relates to an expiration cassette for a ventilator.

[0002] One problem encountered with ventilators involves their disassembly for cleaning and subsequent re-assembly. This particularly concerns the ventilator's expiration section that can comprise an expiratory valve, a flow meter, a pressure gauge, filters etc.

[0003] A simple, sturdy device, allowing replacement of the expiratory components for cleaning in a simple operation, is therefore needed. Ensuring correct re-assembly of ventilator parts after cleaning (or of clean parts) is also important in this context.

[0004] One object of the present invention is to achieve such a device.

[0005] This objective is achieved according to the present invention with an expiration cassette devised according to claim 1.

[0006] Advantageous refinements and embodiments are evident from the dependent claims.

[0007] Placing the desired components, such as a valve, flow meter, pressure gauge etc., for the ventilator's expiration section in a cassette reduces the need for disassembly for cleaning. The entire cassette is appropriately devised for cleaning as a single unit. The cassette itself is only disassembled in exceptional instances.

[0008] Correct insertion of the cassette into the ventilator is assured with a locking mechanism that interacts with a receiving section in the ventilator.

[0009] The locking mechanism in one preferred embodiment has a pushbutton on the top of the cassette. The pushbutton can move between an open position in which the cassette can be removed from the receiving section and a closed position in which the cassette is locked into the receiving section. A spring, or the equivalent, is arranged to act on the pushbutton with a force exerted towards the locking position. The pushbutton interacts with one boss or, advantageously, two bosses that are mechanically connected to the pushbutton. In the pushbutton's locked position, the bosses project beyond the outer edge of the expiration cassette. In the pushbutton's open position, the bosses are inside the outer edge of the expiration cassette. The bosses interact with openings in the receiving section to lock the cassette in place.

[0010] Additional details on the expiration cassette according to the invention are evident from the detailed description below, referring to the following figures, of one embodiment.

FIG. 1 shows a ventilator with an expiration cassette according to the invention,

FIG. 2 shows a locking mechanism in an expiration cassette interacting with a receiving section in the ventilator,

FIG. 3 shows the expiration cassette and receiver

section from another angle, and

FIG. 4 shows an alternate locking mechanism in the expiration cassette.

5 [0011] FIG. 1 shows a ventilator 2 which can be connected to one or more gas sources via gas connections 4A, 4B. The gases can be regulated and mixed in a gas mixer 6 and passed through the inspiratory section 8 of the ventilator 2 to a first connection 10 for a breathing system (not shown).

10 [0012] It should be noted that the term 'ventilator' refers in principle to all types of apparatuses capable of providing breathing assistance, i.e. respirators, anaesthetic machines etc.

15 [0013] The ventilator 2 also comprises a second connection 12 for the breathing system, whereby gas is carried to the expiratory part of the ventilator 2 in which an expiration cassette 14 is arranged. The gas subsequently leaves the ventilator 2 through an evacuation 16.

20 [0014] The expiration cassette 14 is equipped with a handle 18 to facilitate handling and a pushbutton 20 for disengaging the expiratory cassette 14. The pushbutton 20 also serves as an indicator showing that the expiration cassette 14 is correctly connected to the respirator 2. This function is described in greater detail in conjunction with FIG. 2.

25 [0015] A drawing in FIG. 2 shows how a locking mechanism can be devised, in principle, to lock the expiration cassette 14 in a receiving section 22 in the ventilator. In addition to the pushbutton 20, the locking mechanism also contains a first boss 24A and a second boss 24B that interact with a first opening 26A and a second opening 26B, a first mechanical coupling 28A and a second mechanical coupling 28B, a rod 30 and a spring 32. The rod 30 is attached to the pushbutton 20 (or is an integral part of the pushbutton), and the pushbutton's 20 movement is transmitted to the bosses 24A, 24B (whose movement is perpendicular to the pushbutton's 20 direction of movement) by the mechanical couplings 28A, 28B.

30 [0016] Transmission of the movement can be performed with any known mechanical transmission providing simultaneous movement of the pushbutton 20 and the bosses 24A, 24B (and vice-versa). Direct transmission is preferable; since friction-fit transmission could result in impaired functionality caused by e.g. wear etc.

35 [0017] A rack and pinion design has been indicated in the version shown in FIG. 2.

40 [0018] The spring 32 strives to force the pushbutton 20 to assume its upper position (shown in the figure), i.e. the locked position.

45 [0019] In disassembly, the pushbutton is depressed to its lower position, i.e. the open position, whereupon the bosses 24A, 24B are retracted inside the outer edge of the expiration cassette 14, and the expiration cassette 14 can be removed.

50 [0020] When the expiration cassette 14 is inserted in-

to the receiving section 22, the bosses 24A, 24B are pressed inward by the walls of the receiving section 22, whereupon the pushbutton 20 is forced down (towards its lower, open position). When the bosses 24A, 24B pass below the upper part of the openings 26A, 26B, they are forced into the openings because of the spring's 32 pressure on the pushbutton 20. The pushbutton 20 then assumes its upper position, thereby clearly indicating that the expiration cassette has been correctly inserted.

[0021] A gas passage 34 for gas flowing through the expiration cassette 14 is also shown in this FIG.

[0022] FIG. 3 shows another feature of the expiration cassette 14. This figure shows the expiration cassette 14 from the side, during insertion into or removal from the receiving section 22. Here, the expiration cassette 14 is held by the handle 18.

[0023] The receiving section 22 has a stop 36 arranged to interact with the rear end 38 of the expiration cassette 14. In this instance, the locking mechanism (the boss 24A is visible) is arranged at the front end 40 of the expiration cassette 14.

[0024] The stop 36 prevents the rear end 28 of the expiration cassette 14 from being lifted out of the receiving section 22.

[0025] At the same time, the bottom 42 of the receiving section 22 is devised with a raised area 44 (exaggerated in the figure). The raised area makes it necessary for some force to be used, when the expiration cassette 14 is inserted, before the bosses 24A, 24B are able to slip into the openings. This elastic tension therefore facilitates removal of the expiration cassette 14, as its front end 40 is raised somewhat as soon as the pushbutton 20 is depressed to cause the bosses 24A, 24B to retract inside the outer edge of the expiration cassette 14.

[0026] The gas passage 34, an expiratory valve 46 and flow meter 48 have also been depicted in FIG. 3.

[0027] FIG. 4 shows an alternative version of the locking mechanism in the expiration cassette 14. Components identical to those described above have the same designations. The alternative version has a pushbutton 20, a rod 30, a first boss (or piston) 24A, a second boss 24B, a first rotating body 50A, a second rotating body 50B and a leaf spring 52.

[0028] When the pushbutton 20 is depressed, the leaf spring is pushed down, and the bosses 24A, 24B are rotated with the rotating bodies 50A, 50B. The bosses 24A, 24B are accordingly moved in towards the outer edge of the expiration cassette 14, and the expiration cassette 14 can be detached.

[0029] When the expiration cassette 14 is inserted, the expiration cassette 14 is pressed down into the receiving section 22. The bosses 24A, 24B are forced out to the outer edge of the expiration cassette 14, and the pushbutton 20 is pulled down via the rotating bodies 50A, 50B and the leaf spring 52. When the expiration cassette 14 has been pushed down far enough, the

bosses 24A, 24B are moved out into the openings 26A, 26B by the leaf spring's 52 resilient force, and the pushbutton 20 is lifted to indicate a locked position for the expiration cassette 14.

[0030] Other versions of the described embodiment are evident, such as one incorporating one boss instead of two. A single such boss can be arranged on the front of the expiration cassette. The pushbutton can be arranged so it is raised in the locked position and on a level with the top of the expiration cassette in the open position. The pushbutton can be replaced with a lever or the equivalent for achieving movement between two positions. Instead of having a raised area in the bottom of the receiving section, the bottom could instead be sloping or devised with spring-loaded rods that have to be depressed when an expiration cassette is connected. Alternately, the expiration cassette can be devised with a raised area, a sloping area or an area with spring-loaded rods in order to achieve the effect of built-in elastic tension when the expiration cassette is inserted in the receiving section. As already noted, other mechanical systems for transmitting perpendicular motion can be utilized.

Claims

1. An expiration cassette (14) for a ventilator (2), comprising a gas passage (34), an expiratory valve (46) and a flow meter (48), which expiration cassette (14) further comprises a locking mechanism (20, 24A, 24B, 28A, 28B, 30, 32; 50A, 50B, 52) devised for locking and unlocking interaction with a receiving section (22) in the ventilator (2).
2. An expiration cassette according to claim 1, characterised in that the expiration cassette (14) has a specific outer edge devised for the receiving section (22), and the locking mechanism (20, 24A, 24B, 28A, 28B, 30, 32; 50A, 50B, 52) comprises a pushbutton (20) arranged on the top of the expiration cassette (14) and moveable between an open and a locked position, a spring device (32; 52) arranged to exert a force on the pushbutton (20) in a direction towards the locked position and at least one boss (24A, 24B), mechanically connected to the pushbutton (20) and the spring device (32; 52) in such a way that the boss (24A, 24B), in the locked position of the pushbutton, projects beyond the specific outer edge of the expiration cassette (14) and, in the open position of the pushbutton, is inside the specific outer edge of the expiration cassette (14).
3. An expiration cassette according to claim 2, characterised in that the boss (24A, 24B) interacts with an opening (26A, 26B) in the receiving section (22) in order to lock the expiration cassette (14) in place.

4. An expiration cassette according to any of the above claims, **characterised in that** the locking mechanism (20, 24A, 24B, 28A, 28B, 30, 32; 50A, 50B, 52) is arranged at one end (40) of the expiration cassette (14), the other end (38) of the expiration cassette (14) is devised to interact with a stop (36) in the receiving section (22), and the expiration cassette (14) and the receiving section (22) are devised to interact, via an non-flat contact surface (44), thereby making a counteractive force necessary for coupling and locking the expiration cassette (14) and receiving section (22) together.
5. An expiration cassette according to any of the above claims, **characterised in that** the expiration cassette (14) is devised with a handle (18).

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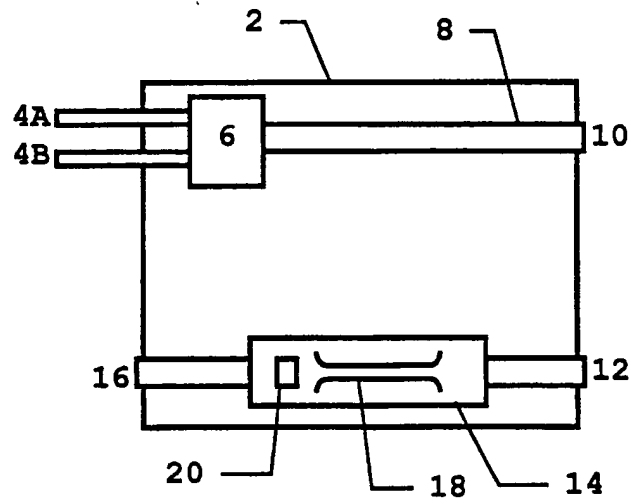


FIG. 1

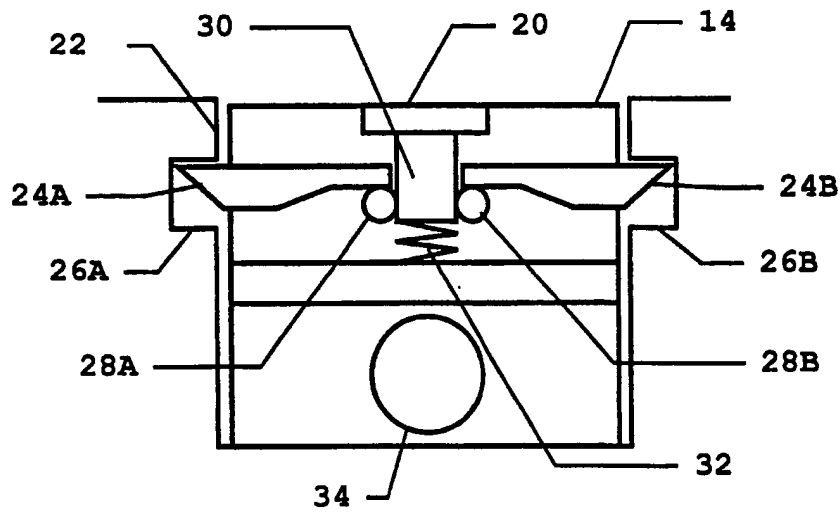


FIG. 2

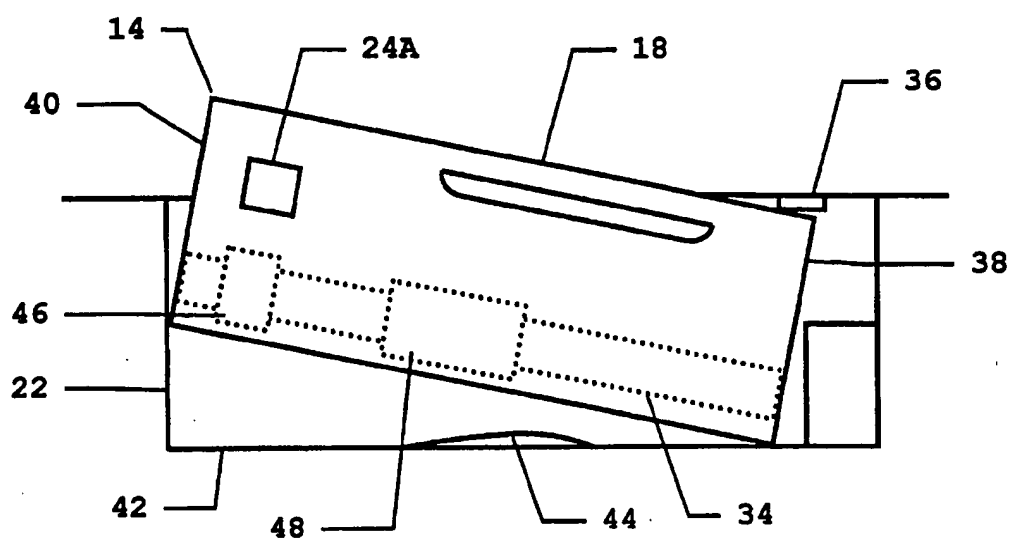


FIG. 3

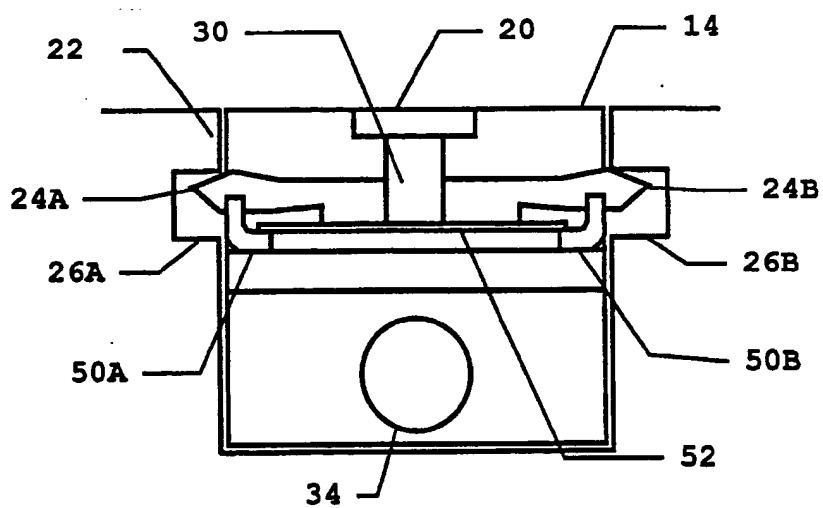


FIG. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 02 00 0152

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A	* page 46, line 35 - page 50, line 35; figures 11A-E *	2-4	
X	WO 99 47197 A (DANTANARAYANA MUDITHA PRADEEP ; SMITH IAN MALCOLM (AU); WICKHAM PET) 23 September 1999 (1999-09-23) * page 7, line 1 - page 9, line 6; claims 1,2; figures 1-6 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			A61M
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 19 June 2002	Examiner Valfort, C
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date O : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03 82 (P21.001)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 02 00 0152

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